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ORIGINAL ARTICLE

Correlation of Gleason Scores Between Needle-Core Biopsy and Radical Prostatectomy Specimens in Patients with Prostate Cancer

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Background: The histologic grade of a prostate needle-core biopsy specimen can determine whether a patient with prostate cancer is a candidate for radical prostatectomy or other treatment. Incorrect histologic grading can result in inappropriate treatment and possible liability. Thus, we conducted this study to determine the histologic-grading accuracy of prostate cancer needle-core biopsy specimens.

Methods: Fifty-two patients with localized prostate cancer treated with radical prostatectomy were included in the study. The overall correlation between Gleason scores for needle-biopsy and prostatectomy specimens was evaluated by analyzing the following parameters: biopsy-core number; accurate biopsy-core length; prostate volume; and preoperative, serum prostate-specific antigen (PSA) level. A "downgrade" was defined as the Gleason score for the prostatectomy specimen being greater than that for the biopsy specimen, whereas an "upgrade" was defined as the converse.

Results: No difference in Gleason scores was noted for 31% of specimens, whereas a downgrade was noted for 40%, and an upgrade for 29%. The accuracy of Gleason scores for biopsy specimens taken by the sextant systemic-biopsy method increased when specimens were > 15 mm in length. No correlation was noted between difference in Gleason scores and biopsy-core number, prostate volume, and preoperative serum PSA level.

Conclusion: The accuracy of Gleason scores determined by needle biopsy in patients with prostate cancer seems to be unreliable. Therefore, further evaluation of patients is necessary. No correlations were noted between biopsy-measured errors in Gleason score and biopsy number, prostate volume, or preoperative serum PSA level. [*J Chin Med Assoc* 2005;68(4):167–171]

Key Words: Gleason score, prostate biopsy, prostate cancer, radical prostatectomy

Introduction

Prostate cancer is the most commonly seen urologic malignancy, and the histologic grade of prostate tumors is an important determinant of disease prognosis and survival.[1,2] Although numerous grading systems exist for the evaluation of prostate cancer, the Gleason grading system is the most widely accepted.[3] This system is based on the glandular pattern of prostate tumors, as identified at relatively low magnification. Both the primary (predominant) and secondary (second most prevalent) architectural patterns are identified and assigned a score from 1–5, with 1 being the most differentiated and 5 the least differentiated. The Gleason scores of prostate biopsy specimens are used to predict the severity of prostate cancer,[4–6] and unless prostatectomy is performed, Gleason scores are determined from such specimens.

The management of patients with localized prostate cancer is based on clinical stage, serum

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prostate-specific antigen (PSA) level, and Gleason score of the prostate biopsy specimen. In patients with high Gleason-score prostate cancer, the likelihood of disease recurrence increases after radical prostatectomy.[4–6] In contrast, many investigators have suggested that patients with clinically localized, well-differentiated or moderately differentiated prostate cancer are not at risk of death from cancer within 10–15 years of diagnosis.[7–9] Although the Gleason score of a prostate biopsy specimen dictates the clinical management of localized prostate cancer, King and Long[10] found that the accuracy of Gleason scores for prostate biopsy specimens was as low as 42%. To our knowledge, the measurement of such accuracy has never been reported in the Taiwanese literature. Therefore, we aimed to determine whether there was a correlation between the Gleason scores of biopsy specimens and the need for radical prostatectomy in patients with prostate cancer.

Methods

Study population

Between April 1996 and July 2002, retropubic radical prostatectomies were performed in 65 patients with clinically localized prostate cancer (stages cT1 and cT2) confirmed by transrectal ultrasound-guided biopsy of the prostate. Prostate cancer was diagnosed in 57 patients at the China Medical University Hospital, and in 8 patients at another institution, but all patients underwent surgery at the former institution. Patients' medical records and pathologic reports were reviewed. Twelve patients were excluded from the study for the following reasons: no detailed medical records ($n = 9$); the tumor volume of biopsy-core specimens was too small to grade ($n = 2$); and salvage prostatectomy had to be performed after biochemical progression after initially curative radiation therapy ($n = 1$).

Biopsy procedure and measurements

Systematic sextant biopsy, as described by Hodge et al,[11] was performed in our institution before October 2002 in 24 patients, and either the 10-core or 12-core biopsy technique (lateral and systematic sextant biopsy), as described by Presti et al,[12] was performed in 20 cases. An 18-gauge, automatic, spring-loaded, core-tissue, biopsy needle (Bard® Magnum®, CR Bard Inc, Covington, GA, USA), with a 22-mm preset length was used for transrectal ultrasound-guided biopsy. The biopsy and prostatectomy specimens were reviewed by 1 staff pathologist, and tumor grade was determined according to the Gleason scoring system.[3]

The overall correlation between Gleason scores for needle-biopsy and prostatectomy specimens was evaluated by comparing the biopsy-core number, accurate biopsy-core length, prostate volume, and preoperative serum PSA level with Gleason scores obtained from needle-biopsy and prostatectomy specimens. Biopsy-core length was measured after biopsy specimens had been fixed in 10% formalin. Prostate volume was measured before such fixation and was calculated by the prolate-ellipsoid volume formula. A "downgrade" was defined as the Gleason score for the tumor specimen from prostatectomy being greater than that for the biopsy specimen, whereas an "upgrade" was defined as the converse.

Statistical analyses

Values for biopsy-core number and accurate biopsy-core length were compared by Fisher's exact test. Univariate analysis was used to determine the correlations of prostate volume and preoperative serum PSA level with differences in Gleason scores between needle-biopsy and prostatectomy specimens. A p value of less than 0.05 was considered statistically significant. All analyses were performed using SPSS version 9.0 (SPSS Inc, Chicago, IL, USA).

Results

Demographic data

Fifty-two patients were included in the study, although 8 of them had undergone prostate biopsy at another institution. Patient age ranged from 49–75 years (mean, 67 years). Preoperative serum PSA level ranged from 1.55–41.45 ng/mL (mean, 15.68 ng/mL), and prostate volume ranged from 16.75–94.24 mL (mean, 50.65 mL).

Gleason scores

Gleason scores ranged from 3–10 for biopsy-core specimens, and from 3–9 for radical prostatectomy specimens. The correlation between Gleason scores obtained from biopsy and prostatectomy specimens is shown in Table 1. There were no differences in Gleason scores in 31% of specimens, but scores were downgraded in 40% of specimens, and upgraded in 29% (Table 2).

Gleason-score differences were examined for possible correlation with the number of biopsy cores, length of biopsy core, prostate volume, and serum PSA level, among the 44 patients who underwent biopsy and prostatectomy at our hospital (Table 3). In sextant systemic biopsy, the accuracy of biopsy-

specimen Gleason scores increased in specimens > 15 mm in length. There was no correlation between Gleason-score difference (prostatectomy minus biopsy) and biopsy-core number, prostate volume, or preoperative serum PSA level.

Gleason scores for 4 prostatectomy specimens were 3 units greater than corresponding scores for biopsy specimens taken from the same individuals (Table 4). Preoperative serum PSA values ranged from 5.76–12.00 ng/mL (mean, 9.88 ng/mL), and prostate vol-

Table 1. Correlation of Gleason scores (GSs) obtained from biopsy (Bx) and radical prostatectomy (RP) specimens

GS of tumor in Bx specimen	GS of tumor in RP specimen								Total
	3	4	5	6	7	8	9	10	
3	2	1	3	0	0	0	0	0	6
4	1	3	3	0	3	0	0	0	10
5	0	2	3	2	3	1	0	0	11
6	0	0	1	4	0	2	0	0	7
7	0	0	2	1	2	2	0	0	7
8	0	0	0	1	2	1	2	0	6
9	0	0	0	0	3	0	1	0	4
10	0	0	0	0	0	1	0	0	1
Total	3	6	12	8	13	7	3	0	52

Table 2. Differences in Gleason scores (GSs) between biopsy (Bx) and radical prostatectomy (RP) specimens

	No difference	Downgrade			Upgrade	
GS difference (RP – Bx)	0	1	2	3	–1	–2
n (%)	16 (31)	9 (17)	8 (15)	4 (8)	8 (15)	7 (13)

Table 3. Correlations of biopsy-core number, biopsy-core length, prostate volume, and preoperative serum prostate-specific antigen (PSA) level, with differences between Gleason scores obtained from biopsy and radical prostatectomy specimens

		Number of cases	No difference *n* (%)	Downgrade *n* (%)	Upgrade *n* (%)	
Biopsy-core						
n	Length (mm)					
6	< 15	12	1 (8)	8 (67)	3 (25)	
	> 15	12	6 (50)	3 (25)	3 (25)	$p = 0.05$*
	Total	24	7 (29)	11 (50)	6 (21)	
10 or 12	< 15	12	2 (17)	6 (50)	4 (33)	
	> 15	8	4 (50)	1 (12)	3 (38)	$p = 0.15$*
	Total	20	6 (30)	7 (35)	7 (35)	$p = 0.71$*
Prostate volume (mL)						
10–19		9	2 (22)	4 (45)	3 (33)	
20–29		13	5 (38)	5 (38)	3 (22)	
30–39		12	4 (33)	7 (59)	1 (8)	
40–49		3	0 (0)	1 (33)	2 (67)	
50–59		7	2 (29)	2 (29)	3 (42)	$p = 0.41^{\dagger}$
PSA (ng/mL)						
0–9		17	8 (47)	4 (24)	5 (29)	
10–19		14	3 (21)	8 (57)	3 (21)	
20–29		9	1 (11)	5 (56)	3 (33)	
30–39		3	1 (33)	1 (33)	1 (33)	
40–49		1	0 (0)	1 (100)	0 (0)	$p = 0.27^{\dagger}$

**Fisher's exact test; †univariate analysis.*

Table 4. Data from 4 cases in which radical prostatectomy (RP) Gleason score (GS) was 3 units greater than the corresponding biopsy (Bx) GS

	Number of Bx cores	Bx-core length (mm)	PSA (ng/mL)	Prostate volume (mL)	Bx GS	RP GS
Case 1	6	> 15	10.22	94.24	2 + 2	4 + 3
Case 2	10	< 15	5.76	28.10	2 + 2	3 + 4
Case 3	10	< 15	12.00	25.70	2 + 2	2 + 5
Case 4	12	< 15	11.55	50.00	2 + 3	3 + 5

PSA = prostate-specific antigen.

ume ranged from 25.70–94.24 mL (mean, 49.51 mL). One patient underwent prostate sextant biopsy before October 2002. The others underwent either 10- or 12-core prostate biopsies after October 2002.

Discussion

This study found that the accuracy of Gleason scores for needle-biopsy specimens of the prostate was only 31%. King and Long[10] pooled data from 10 studies (n = 2,687) and found that such accuracy was 42% (range, 28–58%). They suggested that a methodology using more biopsy cores, combined with consensus in pathologic evaluation, could improve Gleason-score accuracy. However, Thickman et al[13] concluded that 6 biopsy cores were optimal for achieving maximum Gleason-score accuracy, and in the present study, more than 6 biopsy-core specimens did not increase such accuracy.

Bostwick[14] reported that Gleason scores for prostate needle biopsy specimens taken with an 18-gauge needle from 316 patients were only 35% accurate. He did not find any correlation between the error in biopsy Gleason score and prostate volume, prostate weight, or preoperative serum PSA level. In our study, we also found that prostate volume, prostate weight and preoperative serum PSA levels were not linked to the accuracy of Gleason scores for needle-biopsy specimens.

Although all biopsy needles in this study were 18-gauge and had a set length of 22 mm, not all biopsy specimens were the same length. In specimens taken by sextant biopsy, the accuracy of Gleason scores increased when biopsy specimens were > 15 mm in length. However, this correlation was not evident in specimens taken by the 10- or 12-needle biopsy procedure. Ruijter et al[15] suggested that at least 6 biopsy specimens, each measuring 15 mm in length, should be obtained to minimize grading error. Some investigators have suggested that Gleason scores for samples taken with a 14-gauge biopsy needle are more accurate than scores for samples taken with an 18-gauge needle.[16–19] However, other authors have reported that Gleason scores for samples taken with an 18-gauge needle are just as accurate as those for samples taken with a 14-gauge needle.[13,14,20] Adequate biopsy tissue for interpretation increases the accuracy of Gleason scores for needle-biopsy specimens.

Gleason scores for 4 specimens obtained by prostatectomy were 3 units greater than corresponding scores for biopsy specimens taken from the same individuals: 3 of the biopsy specimens had a Gleason score of 2 + 2, and 1 specimen had a score of 2 + 3. However, after analyzing specimens from all 52 patients, we found no correlation between the initial biopsy Gleason score and biopsy-core number, accurate biopsy-core length, prostate volume, or preoperative serum PSA level. One of the patients had a very large prostate (94.24 mL) and only underwent sextant biopsy. The other 3 patients underwent either 10- or 12-core biopsy, but the biopsy-core lengths were < 15 mm. The sampling error in these cases may have been due to grading error.

Although the histologic grade of needle-biopsy specimens is frequently used in clinical decision-making, the reliability of needle-biopsy Gleason score is low.[13,14,21,22] King[23] suggested that, given the clinical implications of Gleason scores, the staging of organ-confined prostate cancer should include the likelihood of histologic upgrading when Gleason scores are used in the following settings: (1) stratification of patients for clinical trials; (2) comparison of results for specific therapies based on biopsy grading; (3) the use of "look-up" tables or formulae to predict risks for upgrading; and (4) the recommendation of radical therapy.

The accuracy of Gleason scores for needle-biopsy specimens in our study was 31%. No correlation between biopsy Gleason-score error and biopsy number, prostate

volume, or preoperative serum PSA level was noted. In conclusion, adequate tissue in biopsy cores is important for accurate tumor grading, and treatment options for prostate cancer should not be based entirely on Gleason scores for needle-biopsy specimens.

References

1. Sogani PC, Israel A, Lieberman PH, Lesser ML, Whitmore WF Jr. Gleason grading of prostate cancer: a predictor of survival. *Urology* 1985;25:223–7.
2. Epstein JI, Pizov G, Walsh PC. Correlation of pathological findings with progression after radical retropubic prostatectomy. *Cancer* 1993;71:3582–93.
3. Gleason DF, Mellinger GT. Veterans Administration Cooperative Urological Research Group: prediction of prognosis for prostate adenocarcinoma by combined histologic grading and clinical staging. *J Urol* 1974;111:58–64.
4. Hull GW, Rabbani F, Abbas F, Wheeler TM, Kattan MW, Scardino PT. Cancer control with radical prostatectomy alone in 1000 consecutive patients. *J Urol* 2002;167:528–34.
5. Kattan MW, Eastham JA, Stapleton AMF, Wheeler TM, Scardino PT. A preoperative nomogram for disease recurrence following radical prostatectomy for prostate cancer. *J Natl Cancer Inst* 1998;90:766–71.
6. Partin AW, Kattan MW, Subong ENP, Walsh PC, Wojno KJ, Oesterling JE, Scardino PT, et al. Combination of prostate-specific-antigen, clinical stage, and Gleason score to predict pathological stage of localized prostate cancer. *JAMA* 1997; 277:1445–51.
7. Fleming C, Wasson JH, Albertsen PC, Barry MJ, Wennberg JE. A decision analysis of alternative treatment strategies for clinical localized prostate cancer. *JAMA* 1993;269:2650–8.
8. Chodak GW. The role of watchful waiting in the management of localized prostate cancer. *J Urol* 1994;152:1766–8.
9. Chodak GW, Thisted RA, Gerber GS, Johansson JE, Adolfsson J, Jones GW, Chisholm GD, et al. Results of conservative management of clinical localized prostate cancer. *N Engl J Med* 1994;330:242–8.
10. King CR, Long JP. Prostate biopsy grading errors: a sampling problem? *Int J Cancer* 2000;90:326–30.
11. Hodge KK, McNeal JE, Terris MD, Stamey TA. Random systemic versus directed ultrasound guided transrectal core biopsies of prostate. *J Urol* 1989;142:71–5.
12. Presti JC, Chang JJ, Bhargava V, Shinohara K. The optimal systematic prostate biopsy scheme should include 8 rather than 6 biopsies: results of a prospective clinical trial. *J Urol* 2000; 163:163–7.
13. Thickman D, Speers WC, Philpott PJ, Shapiro H. Effect of the number of core biopsies of the prostate on predicting Gleason score of prostate cancer. *J Urol* 1996;156:110–3.
14. Bostwick DG. Gleason grading of prostatic needle biopsies: correlation with grade in 316 matched prostatectomies. *Am J Surg Path* 1994;18:796–803.
15. Ruijter E, van Leenders G, Miller G, Debruyne F, van de Kaa C. Errors in histological grading by prostatic needle biopsy specimens: frequency and predisposing factors. *J Pathol* 2000; 192:229–33.
16. Catalona WJ, Stein AJ, Fair WR. Grading errors in prostatic needle biopsies: relation to the accuracy of tumor grade in predicting pelvic lymph node metastasis. *J Urol* 1982;127: 919–27.
17. Lange PH, Narayan P. Understaging and undergrading of prostate cancer: argument for postoperative radiation as adjuvant therapy. *Urology* 1983;21:113–8.
18. Garnett JE, Oyasu R, Grayhack JT. The accuracy of diagnostic biopsy specimens in predicting tumor grades by Gleason's classification of radical prostatectomy specimens. *J Urol* 1984; 131:690–3.
19. Mills SE, Fowler JE Jr. Gleason histological grading of prostatic carcinoma: correlations between biopsy and prostatectomy specimens. *Cancer* 1986;57:346–9.
20. Spires SE, Cibull ML, Wood DP Jr, Miller S, Spires SM, Banks ER. Gleason histologic grading in prostate carcinoma: correlation of 18-gauge core biopsy with prostatectomy. *Arch Path Lab Med* 1994;118:705–8.
21. Cookson MS, Fleshner NE, Soloway SM. Correlation between Gleason score of needle biopsy and radical prostatectomy specimen: accuracy and clinical implications. *J Urol* 1997;157: 559–62.
22. Koksal IT, Ozcan F, Kadioglu TC. Discrepancy between Gleason scores of biopsy and radical prostatectomy specimens. *Eur Urol* 2000;37:670–4.
23. King CR. Patterns of prostate cancer biopsy grading: trends and clinical implications. *Int J Cancer* 2000;90:305–11.